

**This Page Is Inserted by IFW Operations
and is not a part of the Official Record**

BEST AVAILABLE IMAGES

Defective images within this document are accurate representations of the original documents submitted by the applicant.

Defects in the images may include (but are not limited to):

- BLACK BORDERS
- TEXT CUT OFF AT TOP, BOTTOM OR SIDES
- FADED TEXT
- ILLEGIBLE TEXT
- SKEWED/SLANTED IMAGES
- COLORED PHOTOS
- BLACK OR VERY BLACK AND WHITE DARK PHOTOS
- GRAY SCALE DOCUMENTS

IMAGES ARE BEST AVAILABLE COPY.

**As rescanning documents *will not* correct images,
please do not report the images to the
Image Problem Mailbox.**



INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification⁶:

B60J 1/00

A1

(11) International Publication Number:

WO 96/17737

(43) International Publication Date:

13 June 1996 (13.06.96)

(21) International Application Number: PCT/GB95/02847

(22) International Filing Date: 6 December 1995 (06.12.95)

(30) Priority Data:

9424659.2

7 December 1994 (07.12.94)

GB

(71) Applicant (for all designated States except US): BELRON
INTERNATIONAL N.V. [NL/NL]; Kaya Krisolito, P.O.
Box 342, Kralendijk, Bonaire (AN).

(72) Inventors; and

(75) Inventors/Applicants (for US only): LEDGER, Neville,
Richard [GB/GB]; 61 Tan-y-lan Terrace, Morriston SA6
7DU (GB). DAVIES, Christopher [GB/GB]; 20 Pen-y-warc
Road, Llanelli, Dyfed SA15 1JN (GB). CLEMENT, Robert,
Marc [GB/GB]; 11 Plas Road, Pontardawe SA8 3HD (GB).(74) Agent: DAVIES, Gregory, Mark; Urquhart-Dykes & Lord,
Alexandra House, Alexandra Road, Swansea, West Glam-
organ SA1 5ED (GB).(81) Designated States: AM, AT, AU, BB, BG, BR, BY, CA, CH,
CN, CZ, DE, DK, EE, ES, FI, GB, GE, HU, IS, JP, KE,
KG, KP, KR, KZ, LK, LR, LT, LU, LV, MD, MG, MN,
MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK,
TJ, TM, TT, UA, UG, US, UZ, VN, European patent (AT,
BE, CH, DE, DK, ES, FR, GB, GR, IE, IT, LU, MC, NL,
PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN,
ML, MR, NE, SN, TD, TG), ARIPO patent (KE, LS, MW,
SD, SZ, UG).

Published

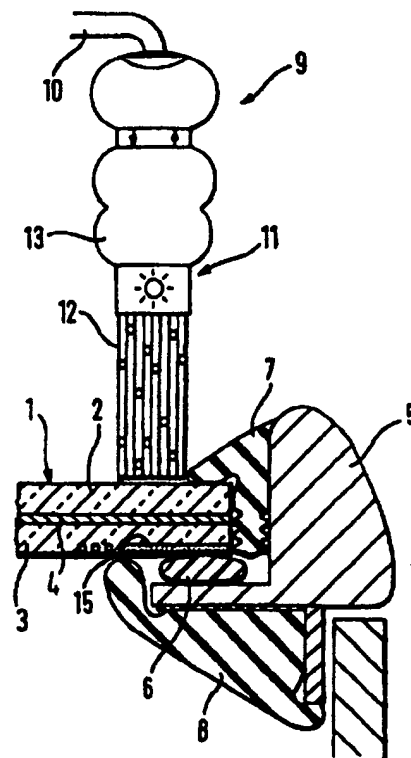
With international search report.

Before the expiration of the time limit for amending the
claims and to be republished in the event of the receipt of
amendments.

(54) Title: RELEASING OF BONDED SCREENS

(57) Abstract

Bonded screens such as vehicle windscreens (1) bonded to a supporting frame (5) by homogeneous bonding material (6) are released by firstly arranging energy delivery means (9) adjacent the screen and subsequently transmitting energy from the delivery means through the screen thereby to effect release of the screen (1) from the frame (5) by either causing degradation of some of the homogeneous bonding material and/or cleavage or degradation of the screen material. The energy delivered may, for example, be ultrasonic or laser radiation, and is preferably arranged to be concentrated at a predetermined localised region to enhance the release mechanism.



FOR THE PURPOSES OF INFORMATION ONLY

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AT	Austria	GB	United Kingdom	MR	Mauritania
AU	Australia	GE	Georgia	MW	Malawi
BB	Barbados	GN	Guinea	NE	Niger
BE	Belgium	GR	Greece	NL	Netherlands
BF	Burkina Faso	HU	Hungary	NO	Norway
BG	Bulgaria	IE	Ireland	NZ	New Zealand
BJ	Benin	IT	Italy	PL	Poland
BR	Brazil	JP	Japan	PT	Portugal
BY	Belarus	KE	Kenya	RO	Romania
CA	Canada	KG	Kyrgyzstan	RU	Russian Federation
CF	Central African Republic	KP	Democratic People's Republic of Korea	SD	Sudan
CG	Congo	KR	Republic of Korea	SE	Sweden
CH	Switzerland	KZ	Kazakhstan	SI	Slovenia
CI	Côte d'Ivoire	LI	Liechtenstein	SK	Slovakia
CM	Cameroon	LK	Sri Lanka	SN	Senegal
CN	China	LU	Luxembourg	TD	Chad
CS	Czechoslovakia	LV	Latvia	TG	Togo
CZ	Czech Republic	MC	Monaco	TJ	Tajikistan
DE	Germany	MD	Republic of Moldova	TT	Trinidad and Tobago
DK	Denmark	MG	Madagascar	UA	Ukraine
ES	Spain	ML	Mali	US	United States of America
FI	Finland	MN	Mongolia	UZ	Uzbekistan
FR	France			VN	Viet Nam
GA	Gabon				

Releasing of Bonded Screens

The present invention relates to means for releasing a screen from a support structure or frame to which the screen is bonded. In particular the invention relates to means for releasing a glass pane or screen (such as a vehicle windscreen) bonded by means of an interposed bonding material to a frame.

Bonded vehicle windscreens commonly need replacing as a result of motoring accidents, vandalism etc. At present, the bonded connection between the windscreen and the support frame is typically released using manual, mechanical means such as the use of sharp angled blades, "cheese wire" techniques etc. Use of these known techniques sometimes causes damage to the vehicle (in particular the bodywork and interior trim) which can be expensive to repair. Furthermore, operatives using these known physical techniques are prone to injury as a result of accidents occurring whilst performing the task.

An alternative proposal for an adhesive joint enabling release of a bonded screen from a supporting frame is disclosed in CA-A-2073092 in which a heatable separating member is provided closely fitting or embedded in an adhesive bead. The heatable sealing member disclosed is heated to a temperature at which it is either destroyed or loses adhesion to closely fitting elements or parts of the joint. The disclosure emphasises that the separating element loses its adhesion or is destroyed at a temperature at which the adhesive bead is not damaged.

A problem with the proposal of CA-A-2073092 is that a relatively complex joint is required incorporating discrete heatable element and separate bonding bead which remains substantially unaffected when the heating element is heated. A further drawback is that at present the commercial market for replacement windscreens is substantially restricted to existing

-2-

vehicles most of which have screens bonded to frames using a single homogeneous bead of polymeric bonding material interposed between the screen and frame. The bonding material is homogeneous to the extent that it is of substantially uniform composition throughout. In this context the homogeneous bonding material may sometimes comprise fillers or other particular additives materials substantially evenly distributed throughout the bonding material.

An improved means of releasing bonded screens has now been devised, which comprises a method of releasing a screen from a frame to which the screen is bonded by interposed homogeneous bonding material, the method comprising the steps of

- (a) arranging energy delivery means adjacent the screen; and
- (b) transmitting energy from said energy delivery means through material comprising the screen thereby to:
 - i) cause degradation of material comprising the homogeneous bonding material; and/or
 - ii) cleavage or degradation of material comprising the screen, thereby to effect release of the screen from the frame.

For performance of the invention in its broadest sense, it is necessary that the screen is transparent to the extent that the energy may be transmitted through the screen to permit release of the screen from the support frame.

The invention is, however, particularly suited for use in releasing (for replacement) vehicle windscreens which are commonly bonded in and to surrounding support frames. In this respect, the screen will typically comprise a material transparent to visible light (such as glass). The homogeneous bonding material preferably comprises a flexible polymeric material (preferably a rubber or elastomeric material such as polyurethane), typically provided as an homogeneous bead extending about the periphery of the screen, interposed between the screen and frame. Such homogeneous bonding material is used in modern vehicle windscreen fitting techniques, almost exclusively.

-3-

It is preferred that the mechanism effecting release of the screen from the frame is pyrolytic degradation of the homogeneous bonding material, preferably of a portion of the body of the material most closely adjacent the screen. The degradation of the bonding material may alternatively be by photodissociation or photochemical degradation. Following degradation and release, a remainder portion of the homogeneous bonding material (substantially un-degraded) remains bonded to the frame. Where the bonding material comprises a synthetic organic polymeric material, the degradation when pyrolytic may comprise carbonisation of the material.

The energy delivery means is arranged adjacent a portion of the screen (typically a peripheral portion of the screen) which is bonded to the frame. The energy is then transmitted through the screen toward the location of the bonding material which is interposed between the respective portions of the screen and frame.

It is preferred that the energy delivery means is arranged to deliver wave energy to be transmitted through a localised region of the screen. The wave energy may be electromagnetic wave energy, such as light, or vibrational/sound energy.

In one embodiment, it is preferred that the energy delivery means comprises laser delivery means arranged to transmit laser radiation through the screen to release the screen from the frame. In this embodiment, it is preferred that the laser delivery means is arranged to transmit laser radiation having a wavelength in the visible/near infra-red region of the spectrum. Alternatively, the laser radiation delivered may be in the ultra-violet region of the spectrum.

The laser energy delivery means is preferably directed such that the radiation is transmitted to and absorbed by the bonding material, preferably in a specific portion (or notional layer) most closely adjacent the screen, as described above.

-4-

The laser radiation may be focused at a predetermined location. Desirably the laser radiation is continuous wave and enables relatively high intensity/energy radiation to be delivered to, and effect degradation (pyrolytically or otherwise) of, specific localised regions of the bonding material, consequently minimising damage to portions of the screen and undegraded portions of the bonding material remaining.

Where the energy delivery means comprises ultrasonic delivery means, an ultrasonic transducer is preferably powered to generate ultrasonic energy of sufficient intensity to effect release of the screen. The ultrasonic energy is preferably arranged to be focused (or concentrated) at a predetermined location. The ultrasonic energy may effect release of the screen by pyrolytic degradation of the bonding material and/or cleavage of material comprising the screen. Alternatively, the ultrasonic energy may effect release by other means, such as for example by means of differential induced stresses at the bonding material/screen interface. It is believed that use of ultrasonic energy to effect release of a screen bonded to a frame may be novel and inventive per se.

Whether laser, ultrasonics, or other energy is used, it is preferred that the energy is arranged to be concentrated.

Desirably, the energy delivery means is arranged adjacent a first face of the screen, the screen being bonded to the support structure at a second, obverse, face.

It is preferred that tuning means is provided arranged to tune the frequency or intensity of the wave energy delivered by the energy delivery means.

Typically, the screen comprises glass and may comprise a glass/plastics laminated structure.

The invention is particularly suitable for the release for repair or replacement of vehicle windscreens; it is however suitable for use in other applications, such as for example release of architectural panels or glass screens (windows) bonded to architectural frames.

-5-

The invention will now be further described in specific embodiments by way of example only, and with reference to the accompanying drawings, in which

Figure 1 is a schematic representation of a first exemplary method according to the invention; and

Figure 2 is a schematic representation of an alternative method according to the invention.

Referring initially to Figures 1 and 2, there is shown a vehicle laminated windscreen 1 comprising a pair of glass sheets 2,3 separated by an intermediate laminating plastics layer 4. Windscreen 1 is bonded to a vehicle windscreen frame 5 by means of an interposed homogeneous rubber bonding bead 6 which extends around the periphery of windscreen 1. Bonding bead 6 comprises a thermoplastic adhesive material applied as a viscous melt to the inner surface of windscreen 1 which is then fitted into frame 5, where bonding bead 6 hardens to securely bond the windscreen 1 to frame 5. The inner surface of windscreen 1 is provided with a peripheral ultra-violet (U.V) barrier comprising a screen-printed layer 15 arranged to inhibit U.V. radiation passing through the windscreen and impinging on the bonding bead 6, which could otherwise adversely affect the integrity of the bond. An external rubber seal 7 and internal vehicle trim 8 are provided at the screen 1/frame 5 connection for weatherproofing and cosmetic reasons respectively.

In order to remove the windscreen from the frame 5, laser delivery system 9 may be used as described below. The laser delivery system comprises a waveguide 10 directing laser radiation from an energy source (not shown) to an applicator head 11 which is placed adjacent the peripheral edge of the windscreen 1 to direct laser radiation through the windscreen 1. Applicator head 11 includes a beam guide 12 and a slidable on/off switch 13.

Continuous wave in laser radiation is directed from applicator head 11 through a localised portion of the windscreen 1 to impinge upon the bonding bead 6. The laser radiation, being

-6-

in the visible and near infra-red region of the electromagnetic spectrum, is absorbed by the bonding bead 6 in the portion thereof immediately adjacent the underside of screen. Only that portion of the bead 6 immediately adjacent the screen 1 increases rapidly in temperature. The rapid temperature increase causes thermal pyrolytic degradation of the portion of the bead 6 immediately beneath screen 6, whilst leaving an underlying remainder layer/portion bonded to the frame.

Alternatively, the laser radiation may be concentrated or focused to heat that portion of the windscreen 1 immediately adjacent bonding bead 6 resulting in fragmentation/degradation or cleavage of the glass adjacent the screen printed layer 15 causing separation of the bonding bead 6 from the remainder of the windscreen.

Applicator head 11 is guided (either automatically or manually) around the entire periphery of the windscreen with the laser radiation activated to ensure complete separation around the entire periphery. The windscreen 1 may then be simply lifted from frame 5 and the surface of the remainder of homogeneous bead 6 pared, prepared and softened for a replacement windscreen to be fitted. Seal 7 may be removed prior to use of the laser delivery system.

A laser delivery system having the following parameters is suitable for performance of the invention.

Wavelength	820 nm
Donor	60 watts
Beam section	18mm by 4mm

The above parameters are given as an example only, and other laser delivery systems could be used providing the energy delivered is sufficient to cause the required degradation and/or fragmentation of the glass.

As an alternative to a laser delivery system, in accordance with the invention other energy delivery means may be utilised. Referring to Figur 3, there is shown apparatus for carrying out the invention utilising ultrasonic energy. An

-7-

ultrasonic piezoceramics transducer 20 is placed in contact with the surface of sheet 2 of the windscreen 1, which has initially been prepared with a couplant gel (not shown) to maximise the proportion of energy transferred from the transducer 20 to the glass sheet 2 of windscreen 1. Ultrasonic acoustic energy is generated by transducer 20 which is connected to an electrical power supply 21. Ultrasound waves are transmitted through the windscreen 1 such that the rubber material of bonding bead 6 is removed either by cleavage of the material of glass sheet 3 immediately backing bead 6, pyrolytic degradation of the portion of bonding bead 6 contacting windscreen 1, or by separation due to ultrasonic vibration at the bead 6/windscreen 1 interface.

The separation or removal can be achieved by using ultrasound of sufficiently high intensity to induce high mechanical stresses within the glass, at the glass/rubber interface or in the bonding bead itself. Furthermore, the acoustic, ultrasonic energy may be focused to produce an enhanced effect, typically by use of a focusing element (not shown) and/or the provision of a suitable transition structure or layer on the contact surface of the transducer 20. Transducer 20 is guided around the entire periphery of the windscreen (either manually or more preferably automatically) to ensure complete release of the screen from the surrounding frame.

CLAIMS:

1. A method of releasing a screen from a frame to which the screen is bonded by interposed homogeneous bonding material, the method comprising the steps of
 - (a) arranging energy delivery means adjacent the screen; and
 - (b) transmitting energy from said energy delivery means through material comprising the screen thereby to:
 - i) cause degradation of material comprising the homogeneous bonding material, and/or
 - ii) cleavage or degradation of material comprising the screen, thereby to effect release of the screen from the frame.
2. A method according to claim 1, wherein a portion only of the bonding material is degraded, a remainder portion of said homogeneous bonding material remaining un-degraded and bonded to the screen or in the frame.
3. A method according to claim 2, wherein the remainder portion of the bonding material remains bonded to the frame.
4. A method according to any preceding claim, wherein the bonding material is provided as a bead extending around the periphery of the screen, the energy delivery means being arranged adjacent a peripheral portion of the screen to effect localised release of a portion of the screen, and tracked to follow the bead around the periphery of the screen thereby to effect complete release of the screen.
5. A method according to any preceding claim, wherein the wave energy delivered is electromagnetic energy of a wavelength and intensity suitable for;

-9-

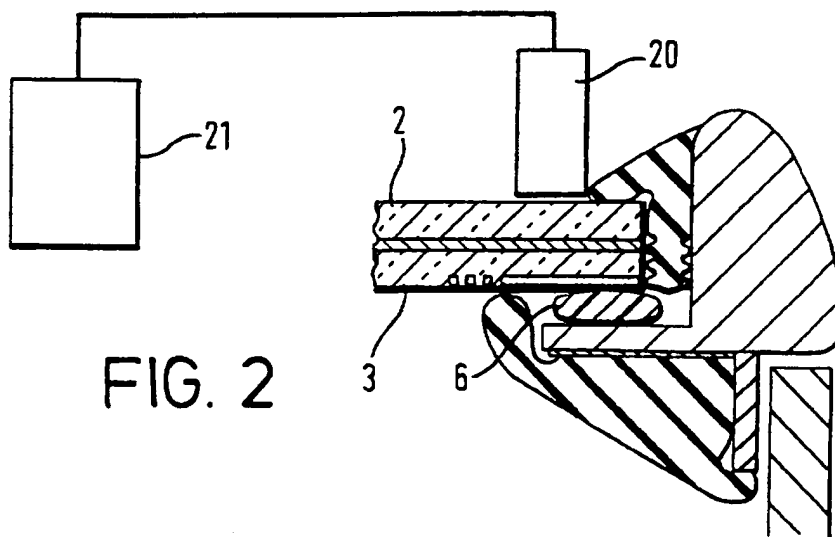
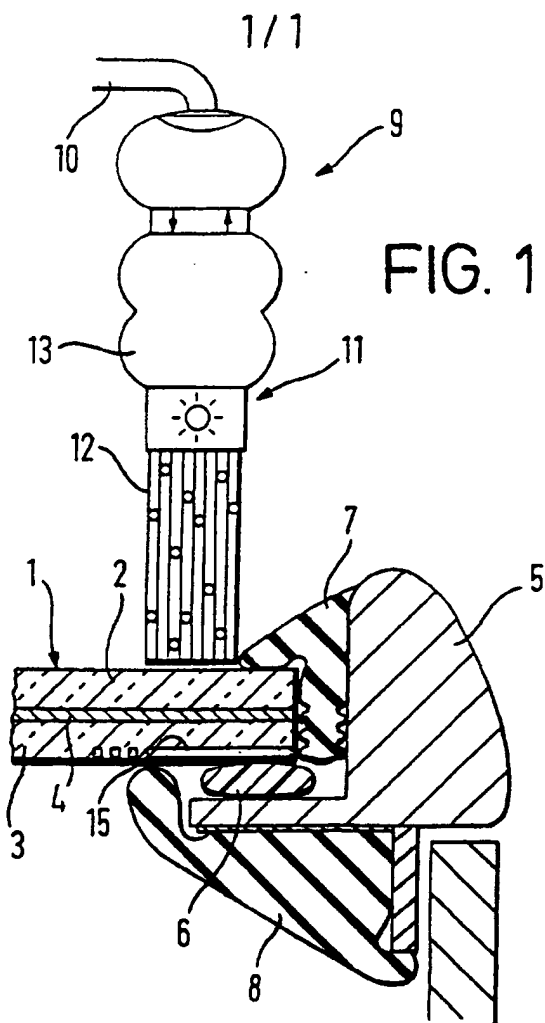
- a) transmissi n through the screen; and
 - b) absorption by the homogeneous bonding material to a degree sufficient to cause degradation thereof, and/or cleavage or degradation of material comprising the screen.
6. A method according to any preceding claim, wherein the energy delivered is arranged to be concentrated at a predetermined location.
 7. A method according to any preceding claim, wherein the energy delivery means comprises laser delivery means arranged to transmit laser radiation through the screen to release the screen from the frame.
 8. A method according to claim 8, wherein the laser radiation is pulsed.
 9. A method according to claim 8, wherein the laser radiation is continuous wave.
 10. A method according to any of claims 7 to 9, wherein the laser delivery means is arranged to transmit laser radiation having a wavelength in the ultra-violet, visible or near infra-red region of the spectrum.
 11. A method according to any of claims 7 to 10, wherein the laser delivery means is arranged to transmit laser radiation having a wavelength substantially in the range 1000 nm or less.
 12. A method according to any of claims 7 to 11, wherein the laser energy delivery means is directed such that the radiation is transmitted to and absorbed at an absorbing layer comprising the screen, the absorbing layer being contiguous with the bonding material bonding the screen to the frame.

-10-

13. A method according to any of claims 8 to 12, wherein the laser radiation is focused at a predetermined location.
14. A method according to any of claims 1 to 5, wherein the energy delivery means comprises ultrasonic delivery means arranged to transmit ultrasonic energy through the screen to effect release of the screen from the frame.
15. A method according to claim 14, wherein the ultrasonic energy is arranged to be focused (or concentrated) at a predetermined location spaced from, or at, a surface of the screen.
16. A method according to any preceding claim wherein the energy delivered is tunable such that the frequency or intensity of the wave energy delivered may be varied.
17. A method of replacing a screen in a frame, the method comprising releasing a frame from the screen in accordance with the method of any preceding claim and subsequently replacing the same screen, or a different screen, in the frame and securing the screen in the frame.
18. Apparatus for use in performing the method of any preceding claim, the apparatus comprising energy delivery means arrangeable adjacent the screen and actuatable to deliver energy through a localised portion of the screen in order to effect release of the screen from the frame.
19. Apparatus according to claim 18 which is arranged to be moved about the periphery of the screen to effect complete release of the screen.

-11-

20. A method of releasing a screen from a frame to which the screen is peripherally bonded by interposed bonding material, the method comprising the steps of:
- (a) arranging laser energy delivery means adjacent the screen;
 - (b) transmitting laser energy from said laser energy delivery means through material comprising the screen thereby to effect localised release of the screen from the frame in the region of transmission of the laser energy; and
 - (c) tracking the laser energy delivery means about the periphery of the screen thereby to effect complete release of the screen from the frame.



INTERNATIONAL SEARCH REPORT

Internat. Application No
PCT/GB 95/02847

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 B60J1/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 B29C B60J

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP,A,0 492 786 (FORD MOTOR COMP.) 1 July 1992 see column 8, line 43 - column 9, line 27; figure 4 see column 9, line 27 - line 31 see column 9, line 40 - line 43 see column 9, line 46 - line 51 see column 4, line 54 - line 58 ---	1,4-6, 16-18
X	US,A,5 269 868 (E. GOFUKU ET AL.) 14 December 1993 see column 5, line 32 - line 45 --- -/-	1,4-8, 10,11, 13,17-20

☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

* Special categories of cited documents:

- *A* document defining the general state of the art which is not considered to be of particular relevance
- *E* earlier document but published on or after the international filing date
- *L* document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- *O* document referring to an oral disclosure, use, exhibition or other means
- *P* document published prior to the international filing date but later than the priority date claimed

T later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

X document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

Y document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

& document member of the same patent family

Date of the actual completion of the international search

16 April 1996

Date of mailing of the international search report

29.04.96

Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,
Fax (+31-70) 340-3016

Authorized officer

Fregosi, A

INTERNATIONAL SEARCH REPORT

Internat Application No
PCT/GB 95/02847

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP,A,0 377 376 (BOUSSOIS S. A.) 11 July 1990 see column 4, line 4 - line 26; figure 1 see column 4, line 38 - column 5, line 5; figures 1-3 ---	1,4-6, 16-18
X	PATENT ABSTRACTS OF JAPAN vol. 8, no. 12 (M-269), 19 January 1984 & JP,A,58 173619 (NITSUSAN SHIYATAI K. K.), 12 October 1983, see abstract; figures 1-3 ---	1,4-6, 17,18
A	EP,A,0 319 023 (ASHLAND OIL INC.) 7 June 1989 see column 4, line 29 - column 5, line 14; figures 2,3 see column 5, line 39 - column 6, line 8; figure 3 ---	1,4-6, 17,18
A	FR,A,2 508 267 (SAINT-GOBAIN VITRAGE) 24 December 1982 see the whole document ---	1,18
A	CA,A,2 073 092 (GURIT-ESSEX AG) 4 January 1993 cited in the application see the whole document -----	1,18

INTERNATIONAL SEARCH REPORT

Information on patent family members

Internat Application No
PCT/GB 95/02847

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP-A-492786	01-07-92	NONE	
US-A-5269868	14-12-93	JP-A- 3126913	30-05-91
EP-A-377376	11-07-90	FR-A- 2641024	29-06-90
EP-A-319023	07-06-89	US-A- 4880580	14-11-89
		CA-A- 1309364	27-10-92
		JP-A- 1199864	11-08-89
		JP-B- 6057430	03-08-94
		US-A- 4941584	17-07-90
FR-A-2508267	24-12-82	DE-A- 3124138	30-12-82
		JP-A- 58024080	12-02-83
		SE-A- 8203717	20-12-82
		US-A- 4555607	26-11-85
CA-A-2073092	04-01-93	AU-B- 1935692	07-01-93
		EP-A- 0521825	07-01-93
		JP-A- 5201246	10-08-93